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1. Your reference

A10736GB-GMD

2. Patent application number
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0228481.8

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Techtronic Industries Company Limited
24/F CDW Building
388 Castle Peak Road
Tsuen Wan, N.T.
Hong Kong

Patents ADP number *(if you know it)*

6548911002

If the applicant is a corporate body, give the country/state of its incorporation

Hong Kong

4. Title of the invention

Head for a Suction Cleaner

5. Name of your agent *(if you have one)*

Forrester Ketley & Co.

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Chamberlain House
Paradise Place
Birmingham
B3 3HP

Patents ADP number *(if you know it)*

133005

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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Number of earlier application	Date of filing *(day / month / year)*

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b) there is an inventor who is not named as an applicant, or
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Continuation sheets of this form	-
Description	11
Claim(s)	5
Abstract	1
Drawing(s)	12 + 12

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Priority documents	-
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	-
Request for preliminary examination and search *(Patents Form 9/77)*	One
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	-

11. I/We request the grant of a patent on the basis of this application.

Signature Forrester Ketley & Co. Date 5 December 2002

Forrester Ketley & Co.

12. Name and daytime telephone number of person to contact in the United Kingdom

Graham M. Dodd
0121 236 0484

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DUPLICATE

PATENTS ACT 1977

A10736GB-GMD

Title: Head for a Suction Cleaner

Description of Invention

The invention relates to a head for a suction cleaner, and in particular to a head including a rotatably driven brush either of the kind adapted for attachment to a wand of a "cylinder" type suction cleaner, or of the kind incorporated in an "upright" type suction cleaner.

Domestic suction cleaners, more commonly called vacuum cleaners, are generally divided into two kinds; "upright" cleaners in which the head is integral with or at least pivotably connected to the main body of the cleaner, and "cylinder" cleaners in which a hose and/or wand connects any tools such as the head to the main body of the cleaner. In the former kind of cleaner the head usually includes a driven brush bar. In the latter kind all tools originally incorporated fixed brushes, but more recently various head designs have been introduced incorporating rotatably driven brushes.

The means of driving such brushes vary. In general in upright cleaners the brush bar is driven by a belt powered by an electric motor, this being either the main motor which provides the suction or a secondary motor provided specifically for that purpose. In cylinder cleaners, some use the suction of the main vacuum cleaner and a turbine in the head to drive the brush, whilst others include an electric motor in the head powered by an electrical supply provided down the hose/wand combination. In the latter case the drive to the brush in the head may be by means of a belt or direct.

One particular problem associated with driven brushes is that the brush bars often get entangled with elongate items which have been vacuumed up, such as pieces of string or ribbon, or even long human hair. This can result in significantly degraded performance because of restricted airflow around the

brush and therefore it is important to remove such entangled items in order to obtain good performance from the vacuum cleaner. However, experience has shown that most users simply do not clear the brush bar as to do so in the prior art cleaners requires the use of tools, generally to remove a sole plate of the head.

It is an object of the present invention to provide an improved form of cleaning tool employing a rotatably driven tool element such as a brush bar which mitigates the above described problems.

According to a first aspect of the present invention there is provided a head for a suction cleaner, the head including:

a rotatably mounted tool element mounted within the head; and

a drive mechanism for rotation of the tool element including a drive belt having internal and external surfaces,

characterised in that

the drive belt does not pass around the tool element.

The invention provides the advantage that the tool element can be removed readily from the drive mechanism.

Preferably the drive mechanism further includes a drive pinion provided on the tool element, and the drive belt is toothed on its external surface and engages with the drive pinion.

The drive mechanism may further include a turbine which drives a turbine pinion engaging the belt. Alternatively it may include an electric motor which drives a motor pinion engaging the belt.

The drive belt may be toothed on its internal surface, and pass around and engage with the turbine or motor pinion. Alternatively the motor or turbine pinion may engage the toothed external surface of the drive belt.

As a possible alternative to the use of a toothed belt, a circumferential drive surface may be provided on the tool element which is engaged frictionally by the external surface of the belt. The drive surface on the tool element may

be in the form of a pulley, e.g. of vee section, and the external surface of the belt have an appropriate corresponding cross-sectional shape to cooperate therewith.

Just as a motor or turbine may have a pinion which engages the toothed internal or external surface of the drive belt, the motor or turbine may have a drive wheel, e.g. a pulley which frictionally engages the internal or external surface of the drive belt.

Conveniently the drive mechanism further includes a support wheel around which the drive belt also passes, and which holds the drive belt adjacent to the in engagement with the drive pinion on the tool element.

The support wheel is preferably freely rotatable and may be a pinion.

Conveniently the head includes lower and upper housing portions, the upper housing portion being pivotable relative to the lower housing portion between a closed position for use and an open position in which the tool element is exposed from above.

Preferably the lower housing portion does not include any part which extends laterally forwardly of the tool element, such that when the upper housing portion is in the open position the tool element is also exposed from the front.

Preferably the head does not include a sole plate.

When the upper housing portion is in the closed position it may define, in combination with the lower housing portion, an airflow opening which in use is adjacent the ground and within which the tool element is located.

The head may further include at least one catch to retain the upper housing portion in the closed position which is releasable without the use of any tool.

Preferably when the upper housing portion is in the open position the drive mechanism is accessible for cleaning or maintenance, and furthermore the tool element is readily removable without the use of any tool.

The ability of the tool element to be readily removed without the use of any tools or implements means that, in addition to the advantage of easy clearing of any entanglement from the tool element, a particular type of tool element may if required be replaced by an alternative type of tool element intended to perform a different function. For example a brush bar intended for use on a carpeted surface may be replaced by a different type of brush bar intended for use on a hard surface, or by a buffing or polishing tool for example. Hitherto the difficulty of removing the tool element has meant that suction cleaner heads have not generally been intended for use with different types of tool element.

Thus, there may be provided a plurality of tool elements, adapted to perform different functions, any one of which may be installed in the head as desired.

Also, when the upper housing portion is in the open position, it is preferred that the airflow paths within the head are accessible for cleaning or maintenance.

When the head includes a turbine for driving the drive belt, the accessible air flow paths within the head may include a path to or from the turbine, or possibly even through the turbine providing access to a rotor thereof in case it should require to be cleaned.

The head may further include a switch for control of the drive mechanism which is open when the upper housing portion is in the open position, such that the drive mechanism cannot be operated, and closed when the upper housing portion is in the closed position, such that the drive mechanism can be operated.

The switch may be activated by a protrusion on an inner surface of the upper housing portion which contacts the switch when the upper housing portion is moved to the closed position.

According to a second aspect of the invention there is provided a suction cleaner including a head according to the first aspect of the invention.

Examples of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is perspective view of an embodiment of a head for a suction cleaner according to the invention;

Figures 2a & 2b are side views of the head of Figure 1, connected to the wand of a suction cleaner, and in (a) a first position and (b) a second position;

Figure 3 is rear perspective view of part of the head of Figure 1, showing the catch in more detail;

Figure 4 is a perspective view of the head of Figure 1 with the upper housing portion in its open position;

Figure 5 is a perspective view of the head of Figure 1 with the upper housing portion in its open position, and the brush bar in the process of being removed;

Figure 6 is an enlarged perspective view of part of the head of the preceding Figures with the cover of the electric motor removed;

Figure 7 is an enlarged perspective view of the drive mechanism for the brush bar of the preceding Figures, with the cover of the electric motor and of the drive belt removed;

Figure 8 is a view corresponding to Figure 7, but of a modified drive mechanism;

Figure 9 is a view as Figure 8, showing a further modification of drive mechanism;

Figure 10 is a plan view of part of the mechanism shown in Figure 9; and

Figure 11 is a view as Figures 8 to 9, showing yet a further modification of the drive mechanism.

Referring to the Figures, a head 10 comprises a lower housing portion 12, an upper housing portion 14 and a connector portion 16 for connection of the head 10 to a wand 18 of a suction cleaner (not shown). The connector portion 16 is pivotally secured to the lower housing portion 12, as best illustrated in Figures 2 and 3; Figure 2 showing the general relationship between the components in normal use and Figure 3 showing the general relationship between the components in storage or when reaching under furniture for example. The ability to reach the flat position shown in Figure 2b is provided by the raised pivot axis A of the connector portion 16 relative to the lower housing portion 12 with respect to the ground.

The upper housing portion 14 is pivotable about an axis B between a closed position shown in Figures 1 and 2 and an open position as shown in Figures 4 to 6. The upper housing portion of 14 is retained in the closed position by means of catches 22, located towards either side of the head 10. The catches 22 comprise a conventional form of over-centre mechanism, as shown in Figure 3. They operate as follows: lower link 22a is released by pulling upwards as indicated by arrow X, the catch 22 then pivots up and forwards as indicated by arrow Y to release. The reverse is undertaken to resecure the catches 22. Thus it can be seen that the catches 22 can be released, and resecured, without the use of any tool.

The lower housing portion 12 provides ground engaging wheels 20 to either side towards the rear thereof. It also provides pivotally mounted brush bar retaining cradles 24 to either side towards the front thereof, for support of a tool element, in this case a conventional brush bar 26. The brush bar retaining cradles 24 are pivotable about an axis C located rearwardly and above the location of the brush bar 26 in use. The brush bar 26 has on either end a removable end cap 28, retained on the brush bar 26 by friction. The purpose of the pivotable brush bar retaining cradles 24 and removable end caps 28 will

become apparent in due course when the removability of the brush bar 26 is described.

The brush bar is selectively driven using a drive mechanism as will now be described. The lower housing portion 12 of provides support for an electric motor 30 and associated control unit 32, and motor cover 34 (shown in removed in Figures 5 to 8). The motor 30 provides the drive for the brush bar 26 via motor pinion 35, and a drive belt 36 which is toothed on both internal and external outside surfaces 36a and 36b and which also passes around support wheel 37 (which may or may not be toothed). The drive belt 36 engages with drive pinion 38 located on the brush bar 26, by means of its toothed external surface 36b. Thus the drive of the brush bar 26 is achieved without the need for the drive belt 36 to pass around the brush bar 26.

The path of the drive belt 36 is enclosed within a cover comprising a first cover part 40 provided by the lower housing portion 12, and a second cover part 42 provided by the upper housing portion 14. The cover provided by first and second cover parts 40, 42 means that the drive belt 36 is completely enclosed in use and thus protected from dirt and damage.

The control unit 32 for the motor 30 includes a switch 44 which is activated by a protrusion 46 provided on an inner surface of the upper housing portion 14. As the upper housing portion 14 is moved from its open position to its closed position the protrusion 46 operates external button 48 of the switch 44. The switch 44 is provided as a safety feature to ensure that the motor 30 cannot be operated to drive the brush bar 26 whilst the upper housing portion 14 is in its open position. Thus, the motor 30 can only be operated to drive the brush bar 26 when the protrusion 46 has operated the button 48 to close switch 44.

The control unit 32 further includes indicator lights 50, in this embodiment three of them, on its upper surface which can be viewed through an opening in motor cover 34, and an opening 52 in the upper housing portion

14. The indicator lights 50 can, for example, be used to indicate that (a) a supply of electricity is provided to the control unit 32, (b) the motor 30 is being operated such that the brush bar 26 is rotating, and (c) that the brush bar is not rotating, i.e. has been fouled by some debris. Conveniently the lights for (a) and (b) may be green LEDs and the light for (c) may be a red LED. Clearly the number of indicator lights provided and what they indicate may be varied as desired, for example they may indicate whether the brush bar is rotating at full speed or at a lower speed.

When the upper housing portion 14 is in its closed position it, in combination with the lower housing portion 12, defines an airflow opening 54, in which the brush bar 26 is located. The airflow opening 54 communicates with airflow passages 56 within the head 10 and positioned to either side of the motor 30 and control unit 32, and defined partly by the lower housing portion 12 and partly by the upper housing portion 14. The airflow passages 56 combine to form a single airflow passage (not shown) where the upper and lower housing portions 12, 14 are secured to the connector portion 16. The use of two airflow passages 56 to connect the airflow opening 54 to the single airflow passage which passes up the wand 18 of the suction cleaner provides for more even suction across the width of the airflow opening 54.

The construction of the head 10 as described above provides the ability for simple removal of the brush bar 26 for, for example, cleaning or maintenance of the head 10. To remove the brush bar 26 the following steps are taken. The catches 22 are released and the upper housing portion 14 is pivoted upwardly about the axis B, to the position shown in Figure 4. In that position the brush bar 26 is accessible from above, below and the front as indicated by arrows D, E and F in Figure 4. This is particularly the case because the lower housing portion 12 does not include any part which extends laterally between its sides forward of the brush bar 26, and because the head 10 does not include any sole plate or the like.

The brush bar retaining cradles 24 are then gripped and pivoted upwardly and rearwardly about axis C as indicated by arrows G in Figure 5. Next the end caps 28 are gripped and pulled outwardly as indicated by arrows H in Figure 5, to remove them from the ends of the brush bar 26. The brush bar 26 can then simply be lifted upwards and out of the head 10 as indicated by arrow I in Figure 5. This simple removal is assisted by the fact that the drive belt 36 does not pass around the brush bar 26.

As will be understood the brush bar 26 can be removed from the head 10 very simply and without the use of any tool. This facilitates the cleaning of the brush bar 26 when it has become entangled as previously described. However, it also facilitates the cleaning of the air passages 56, which can readily become blocked if inappropriate items are sucked up using the suction cleaner.

Furthermore, the brush bar 26 can be replaced within the head 10 by simply reversing the steps described above, and again without the use of any tool. Thus, the brush bar 26 can be cleaned, the airflow passages 56 cleared, and the brush bar 26, or an alternative form of tool element, replaced in the head without the need of a single tool. As a result users of the suction cleaner concerned are much more likely to undertake such simple cleaning and maintenance than would be the case with prior art heads.

Tool elements provided with the head 10 may take the form of different kinds of brush bar specifically adapted for different floor surfaces with different bristle densities and/or hardnesses, and other forms such as buffing bars for buffing and polishing of hard floors with the bristles replaced by pads.

The above described embodiment incorporates within the drive mechanism an electric motor, but the invention is not limited to heads using such drive mechanisms. The invention may also be implemented in other forms of heads, in particular those in which the drive is supplied by means of a turbine driven by the suction of the cleaner. Such heads are often referred to as "turbo" heads.

Figure 8 illustrates, in a view corresponding to part of Figure 7, such a "turbo" head. Parts appearing in Figure 7 are identified by the same reference numerals as previously used: the difference is that instead of the electric motor 30 there is a turbine rotor 60 having blades 61, carried by a rotatably-supported shaft having pinion 35 at its end. The rotor 60 is disposed within a housing part 62 of the lower housing portion 12 and a corresponding part (not shown) of the upper housing portion 14 together affording a chamber accommodating the rotor. An air inlet to such chamber from the region of the brush bar 26 is indicated at 63, and an outlet (not shown) from the chamber leads to the connector portion 16 in the vicinity of where the air flow passages 56 join. Thus part of the suction airstream passes through the chamber causing the rotor 60 to revolve and drive the belt 36, possibly by way of a suitable reduction gearing.

When the upper housing portion 14 is pivoted to its open position relative to the lower housing portion 12, it may give access as illustrated to the turbine rotor 16 within its chamber, and the passages for airflow to and from the chamber, to facilitate cleaning of these parts if it is required. However, such cleaning of the turbine is likely to be necessary much less frequently than is cleaning of the brush bar, and thus the pivotal opening of the housing portion 14 need not give access to the turbine interior. The turbine may in this case be a unit at least partly having its own housing, disposed within the housing 12, 14 of the head 10.

Referring now to Figure 9 of the drawings, this shows a further embodiment with an electric motor 30 whose shaft is provided with a pulley 65 instead of the pinion 35. A belt 66 is entrained around the pulley 65 and a support wheel 67 which is also in the form of a pulley rather than the pinion 37. The cross-sectional shape of the interior surface of belt 66 which engages the pulley 65 and support wheel 67 may be of "Vee-belt" form and the pulley and support wheel may be correspondingly shaped to be engaged by the belt. The

brush bar 26 has a drive surface 68 which is engaged by the external surface of the belt to be driven frictionally thereby. The cross-sectional shape of the drive surface part 68 on the brush bar, and of the external surface of the belt 66 may be that of a vee pulley and belt respectively, or any other suitable profile for frictional driving, e.g. part-circular or possibly even flat.

Figure 10 shows diagrammatically, in a partly sectioned view, the arrangement of the pulley 65, belt 66, support wheel 67, and brush bar drive wheel part 68 of Figure 9. The support wheel 67 is shown to be biased by springs 69 away from the pulley 65, to maintain tension in the belt between the pulley 65 and support wheel 67 and to establish good frictional driving conditions with the drive surface of the brush bar. The belt 66 is shown as having a vee profile on both its internal and external surfaces.

Referring finally now to Figure 11, this shows an embodiment wherein the drive belt 36 is provided with teeth at 36b on its external surface, but its internal surface 36a is not toothed. Instead of extending around the pinion 35 driven by an electric motor 30 (or by a turbine), the belt extends around a further support wheel 70 positioned adjacent the pinion 35 and the pinion engages the toothed external surface 36b of the belt. The belt engages the brush bar pinion 38 as above described. This arrangement of a drive mechanism, using a belt toothed on one only of its surfaces, may be valuable in certain arrangements of brush bar and motor in the head.

It would further alternatively be possible for a pulley on the drive shaft of a motor or turbine to engage the external surface of a drive belt of suitable cross-sectional shape, for example as shown in Figures 9 and 10, frictionally to drive the belt.

Although the invention has been described in connection with the head of a cylinder type suction cleaner which is secured for use to a wand of the cleaner, it is equally applicable to the heads of upright type suction cleaners.

In the present specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A head for a suction cleaner, the head including:

a rotatably mounted tool element mounted within the head; and

a drive mechanism for rotation of the tool element including a drive belt having internal and external surfaces,

characterised in that

the drive belt does not pass around the tool element.

2. A head for a suction cleaner according to claim 1 characterised in that the drive mechanism further includes a drive pinion provided on the tool element, and in that the drive belt is toothed on its external surface and engages with the drive pinion.

3. A head for a suction cleaner according to claim 1 characterised in that a circumferential drive surface is provided on the tool element and the external surface of the belt frictionally engages the drive surface.

4. A head for a suction cleaner according to claim 3 characterised in that the drive surface is a pulley and the external surface of the belt has a cross-section which cooperates with the pulley.

5. A head for a suction cleaner according to claim 1 or 2 characterised in that the drive mechanism further includes a turbine which drives a turbine pinion engaging the belt.

6. A head for a suction cleaner according to claim 1 or 2 characterised in that the drive mechanism further includes an electric motor which drives a motor pinion engaging the belt.

7. A head for a suction cleaner according to claim 5 or 6 characterised in that the drive belt is toothed on its internal surface, passes around, and engages with the turbine or motor pinion.

8. A head for a suction cleaner according to claim 5 or 6 as appendant to claim 2 characterised in that the turbine or motor pinion engages the toothed external surface of the drive belt.

9. A head for a suction cleaner according to claim 3 or 4 characterised in that the drive mechanism further includes a motor or turbine having a drive wheel which frictionally engages the drive belt.

10. A head for a suction cleaner according to any one of the preceding claims characterised in that the drive mechanism further includes a support wheel around which the drive belt also passes, and which holds the drive belt adjacent to and in engagement with the tool element.

11. A head for a suction cleaner according to claim 10 characterised in that the support wheel is freely rotatable.

12. A head for a suction cleaner according to claim 10 or 11 characterised in that the support wheel is a pinion.

13. A head for a suction cleaner according to any one of the preceding claims characterised in that the head includes lower and upper housing portions, the upper housing portion being pivotable relative to the lower housing portion between a closed position for use and an open position in which the tool element is exposed from above.

14. A head for a suction cleaner according to claim 13 characterised in that the lower housing portion does not include any part which extends laterally forwardly of the tool element, such that when the upper housing portion is in the open position the tool element is also exposed from the front.

15. A head for a suction cleaner according to claim 13 or 14 characterised in that it does not include a sole plate.

16. A head for a suction cleaner according to any one of claims 13 to 15 characterised in that when the upper housing portion is in the closed position it defines, in combination with the lower housing portion, an airflow opening which in use is adjacent the ground and within which the tool element is located.

17. A head for a suction cleaner according to any one of claims 13 to 16 characterised in that it further includes at least one catch to retain the upper housing portion in the closed position which is releasable without the use of any tool.

18. A head for a suction cleaner according to any one of claims 13 to 17 characterised in that when the upper housing portion is in the open position the drive mechanism is accessible for cleaning or maintenance.

19. A head for a suction cleaner according to claim 18 characterised in that the tool element is readily removable without the use of any tool.

20. A head for a suction cleaner according to claim 19 characterised in that a plurality of different tool elements is provided, adapted to perform different functions, any one of which can be installed in the head as desired.

21. A head for a suction cleaner according to any one of claims 13 to 20 characterised in that when the upper housing portion is in the open position airflow paths within the head are accessible for cleaning or maintenance.

22. A head for a suction cleaner according to claim 21 wherein said airflow paths include a path to, and/or from, and/or through a or the turbine.

23. A head for a suction cleaner according to any one of claims 13 to 21 as dependent upon claim 6 characterised in that it further includes a switch for control of the drive mechanism which is open when the upper housing portion is in the open position, such that the drive mechanism cannot be operated, and closed when the upper housing portion is in the closed position, such that the drive mechanism can be operated.

24. A head for a suction cleaner according to claim 23 characterised in that the switch is activated by a protrusion on an inner surface of the upper housing portion which contacts the switch when the upper housing portion is moved to the closed position.

25. A head for a suction cleaner substantially as hereinbefore described with reference to the accompanying drawings.

26. A suction cleaner including a head according to any one of the preceding claims.

27. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

ABSTRACT

Title: Head for a Suction Cleaner

A head (10) for a suction cleaner is described. The head (10) including: a rotatably mounted tool element (26) mounted within the head (10); and a drive mechanism for rotation of the tool element (26) including a drive belt (36) having internal and external surfaces (36a, 36b). The drive belt (36) does not pass around the tool element (26).

The drive mechanism further includes a drive belt pinion (38) provided on the tool element (26). The drive belt (36) is toothed on its external surface (36b) and engages with the drive belt pinion (38).

The drive for the drive mechanism may be provided by any appropriate means, for examples an electric motor or a turbine. Thus the drive mechanism also includes an electric motor (30), (or a turbine), which drives a motor (or turbine) pinion (35), and the drive belt (36) is toothed on its internal surface (36a), passes around and engages with the motor (or turbine) pinion (35).

The tool element may take the form of a conventional brush bar (26), or may take other forms.

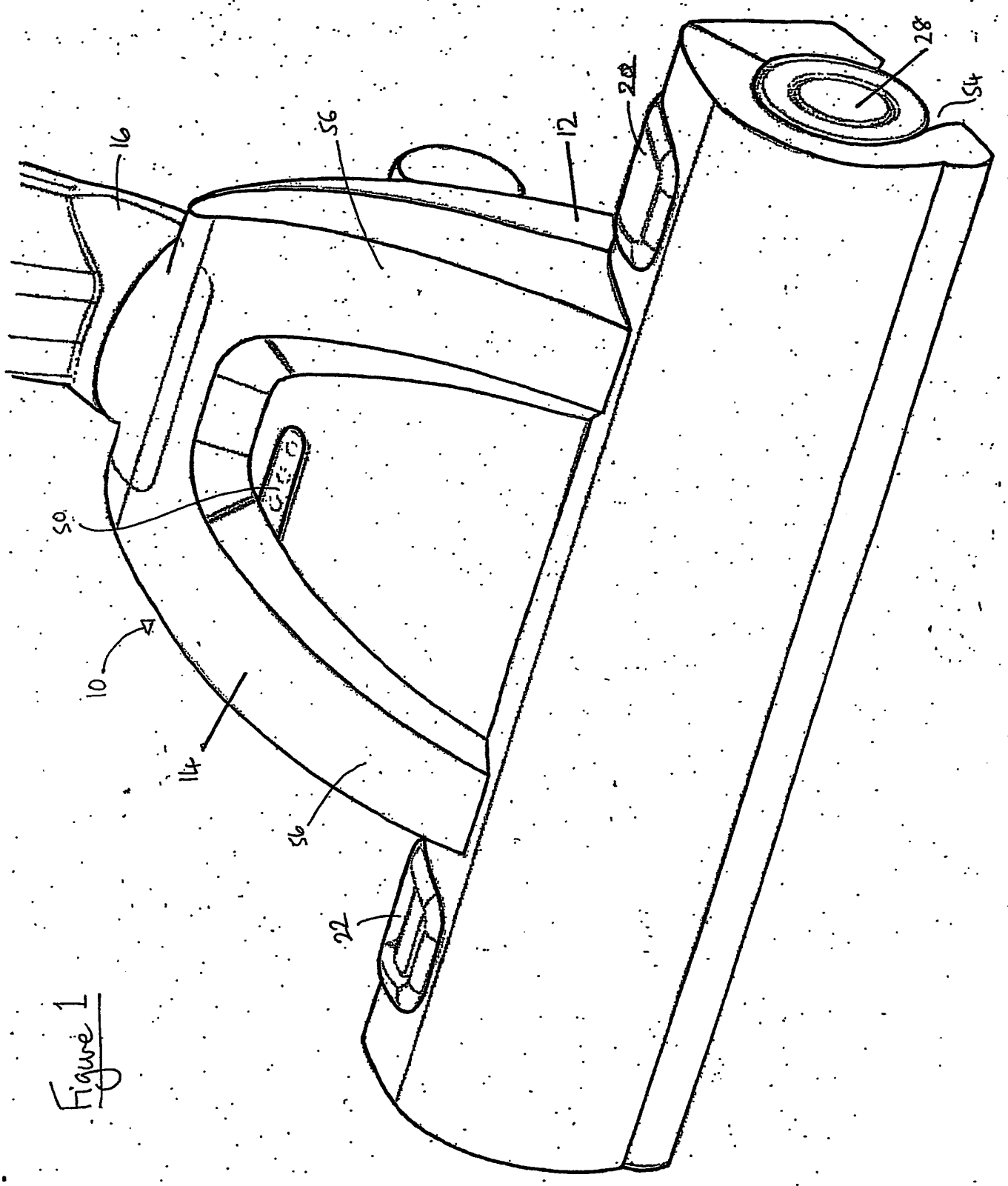


Figure 1

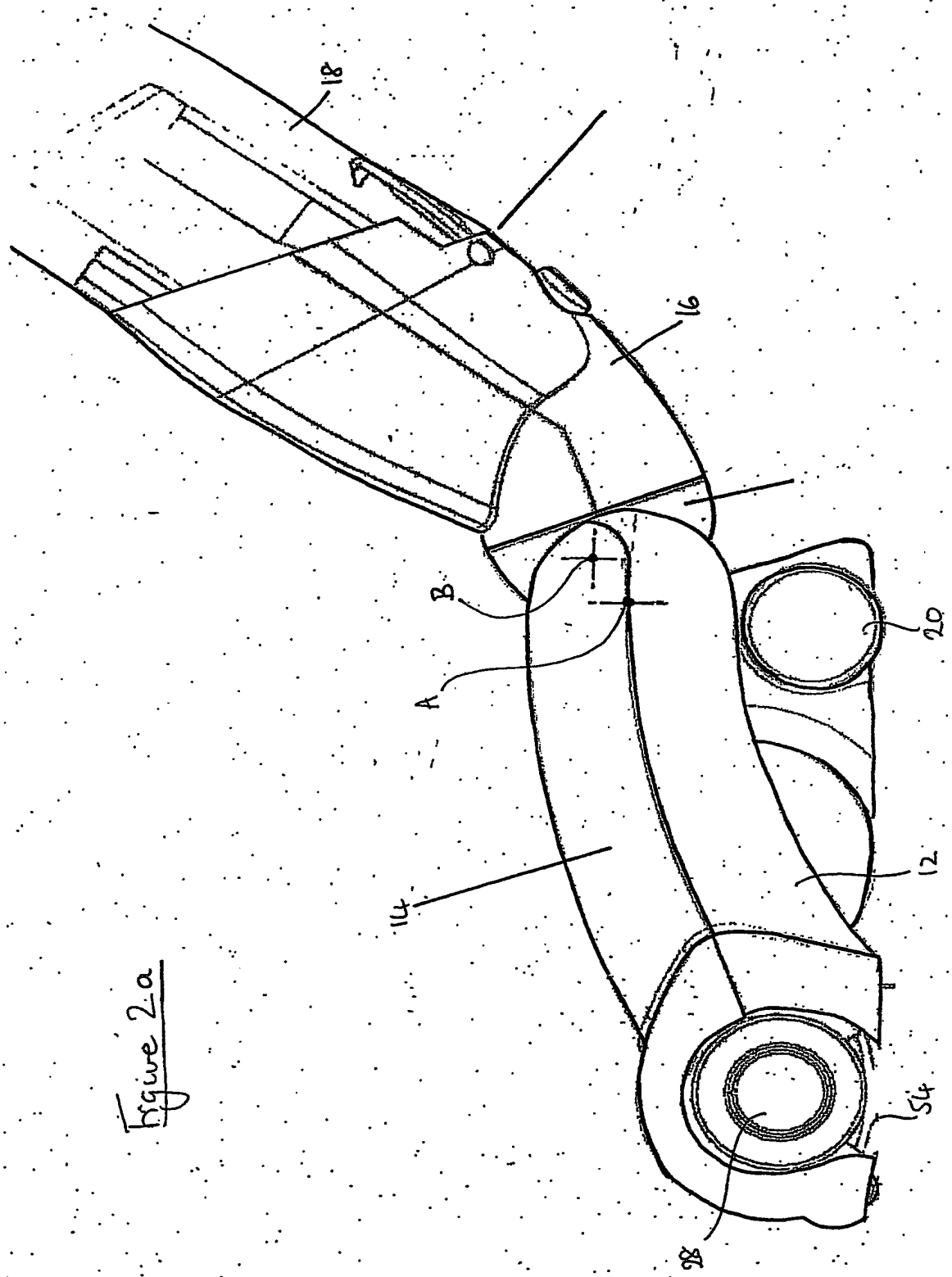


Figure 2a

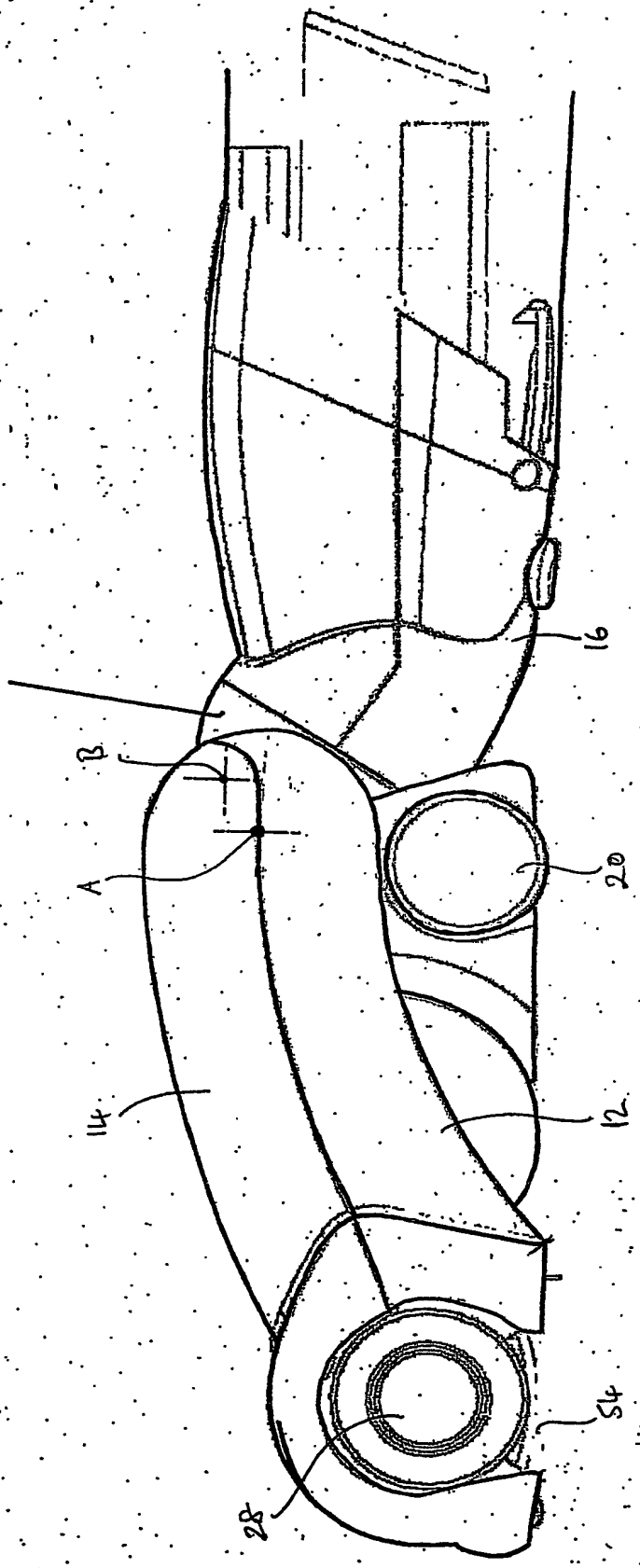


Figure 2b

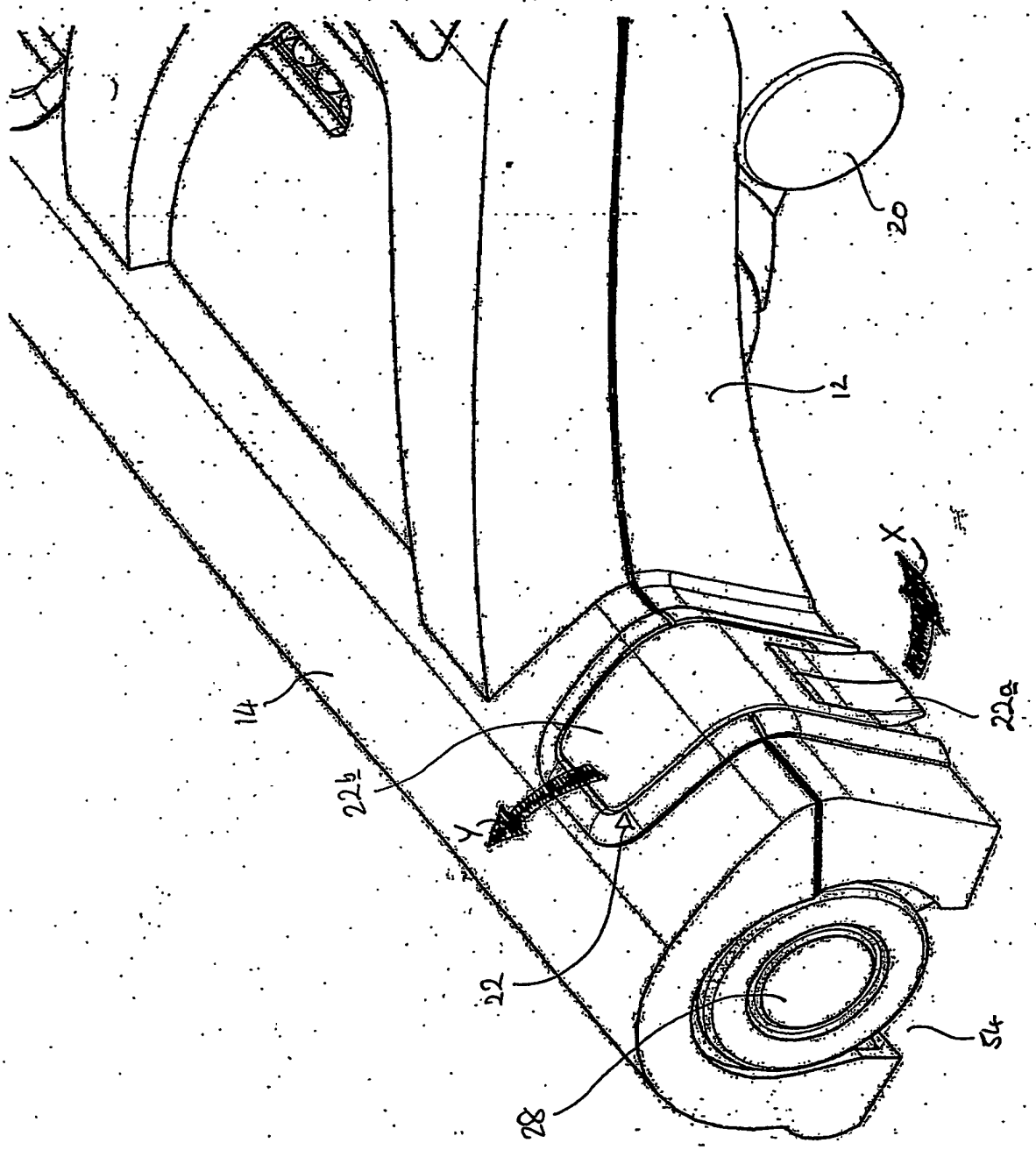
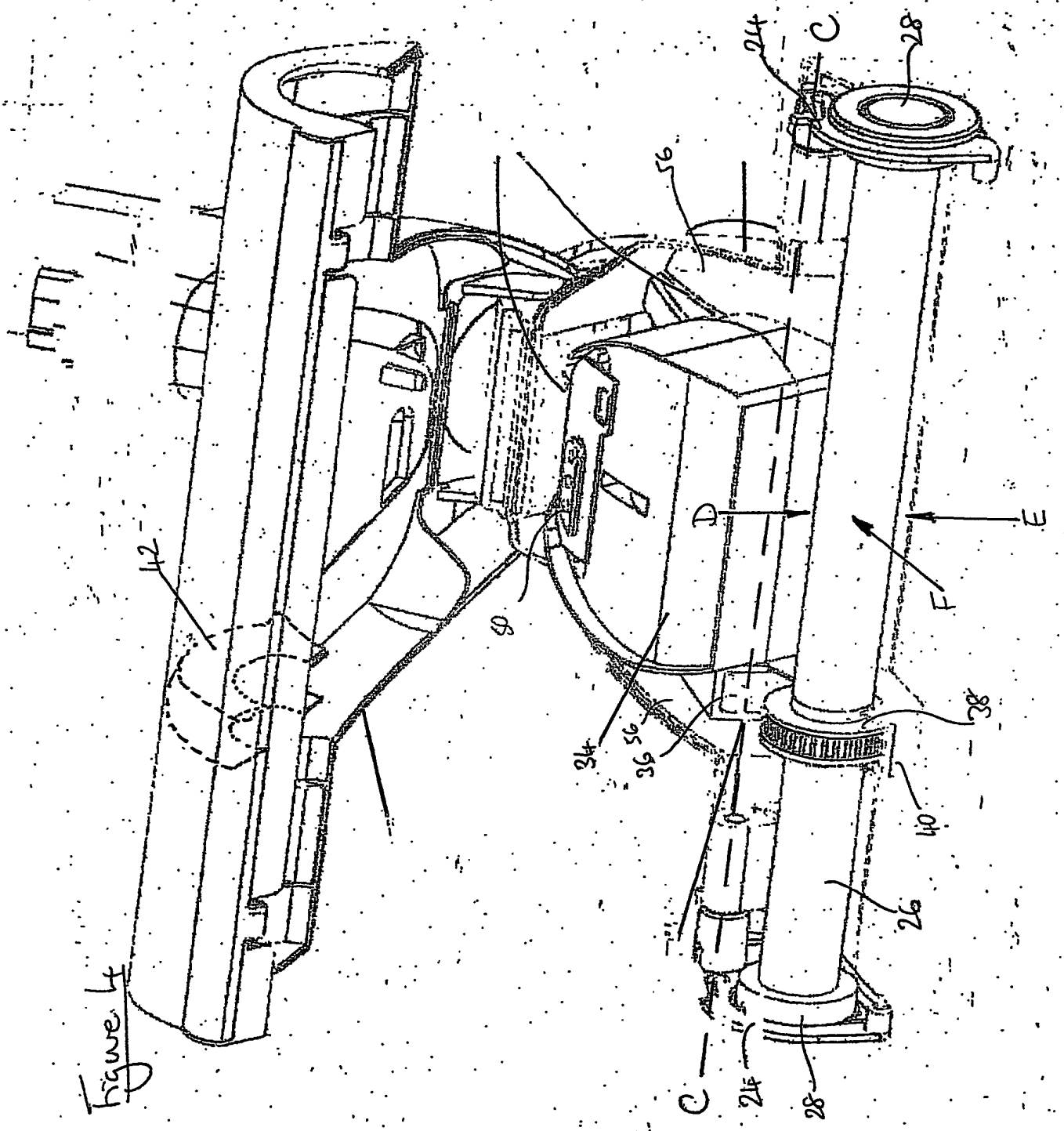


Figure 3



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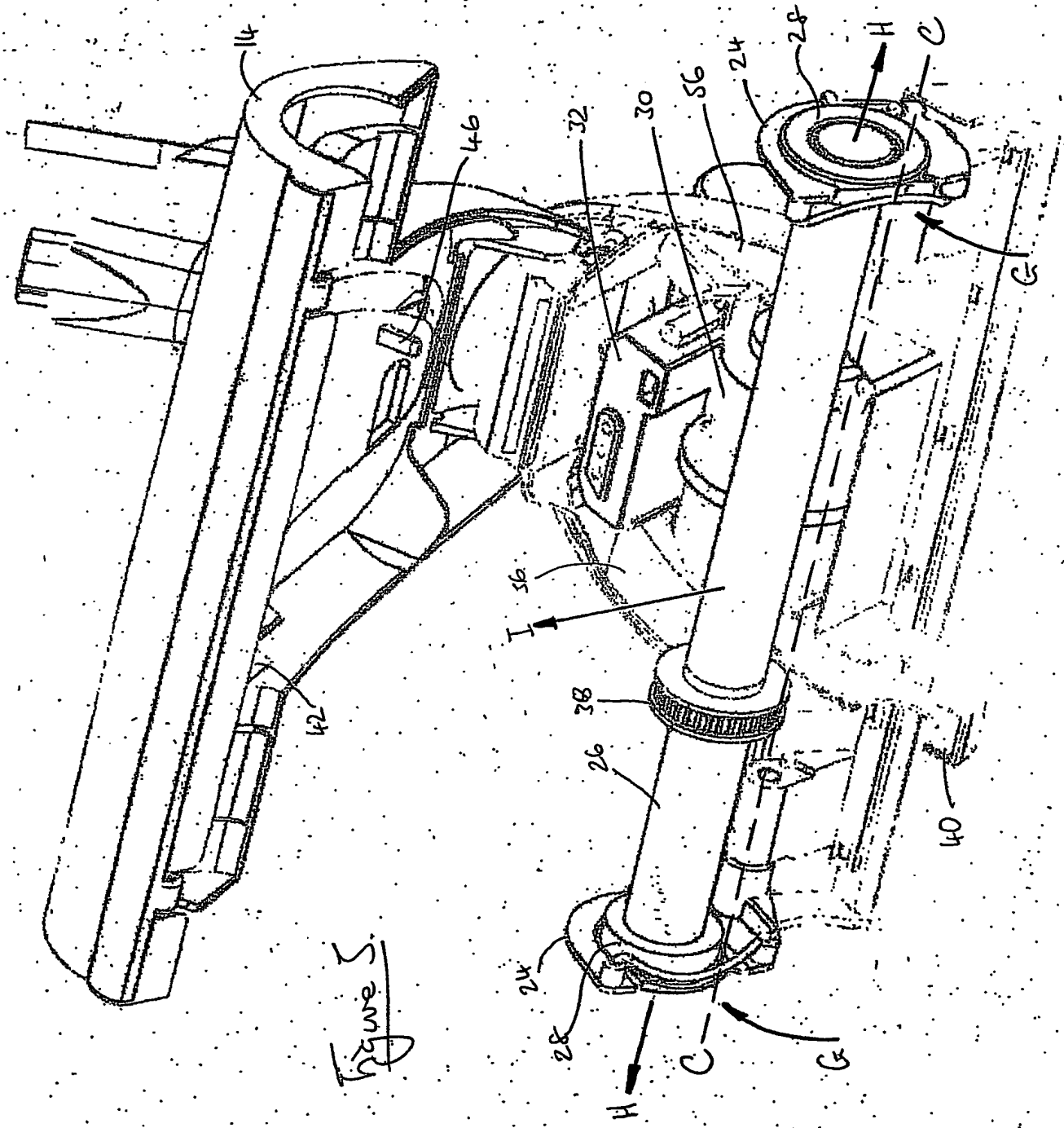

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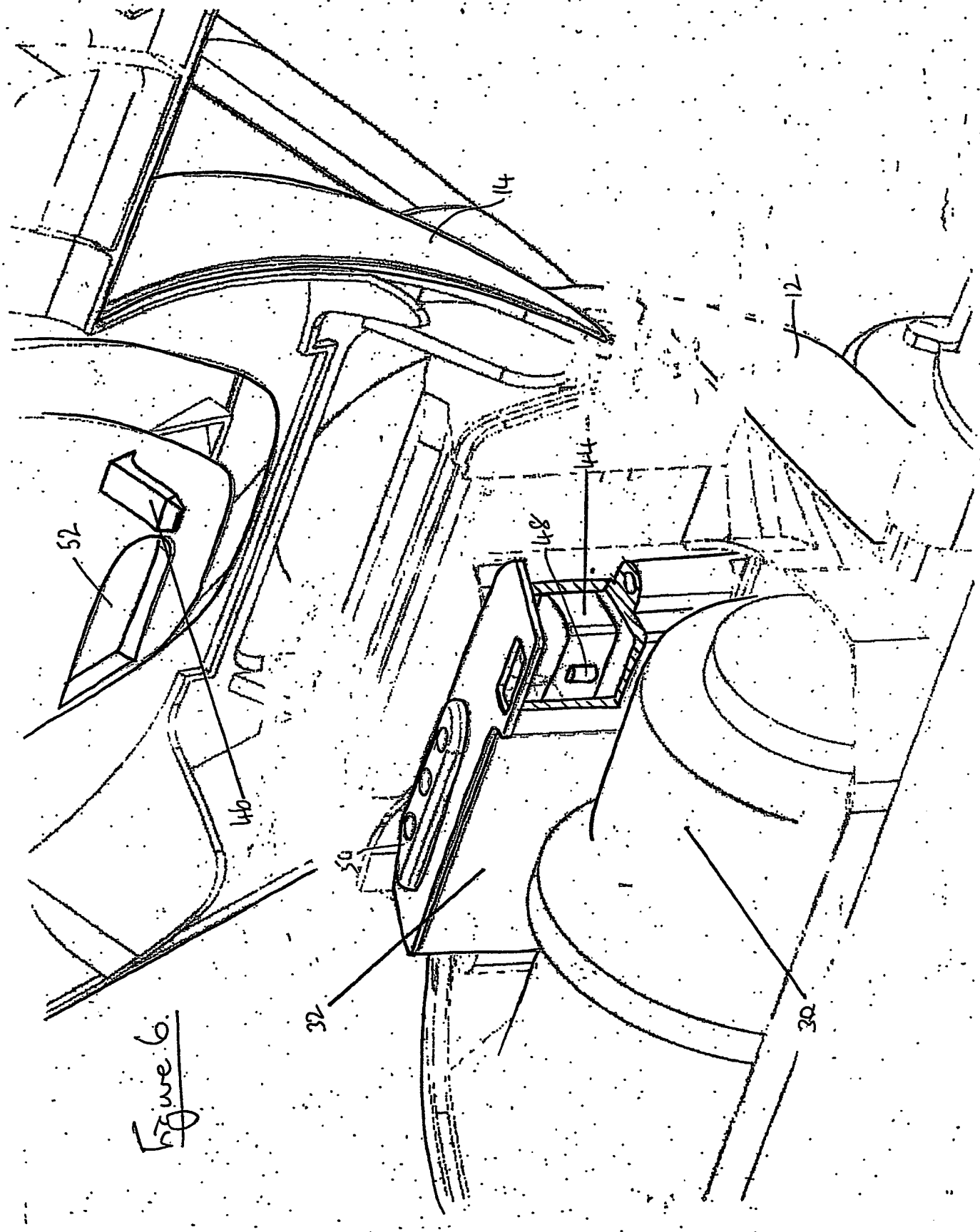

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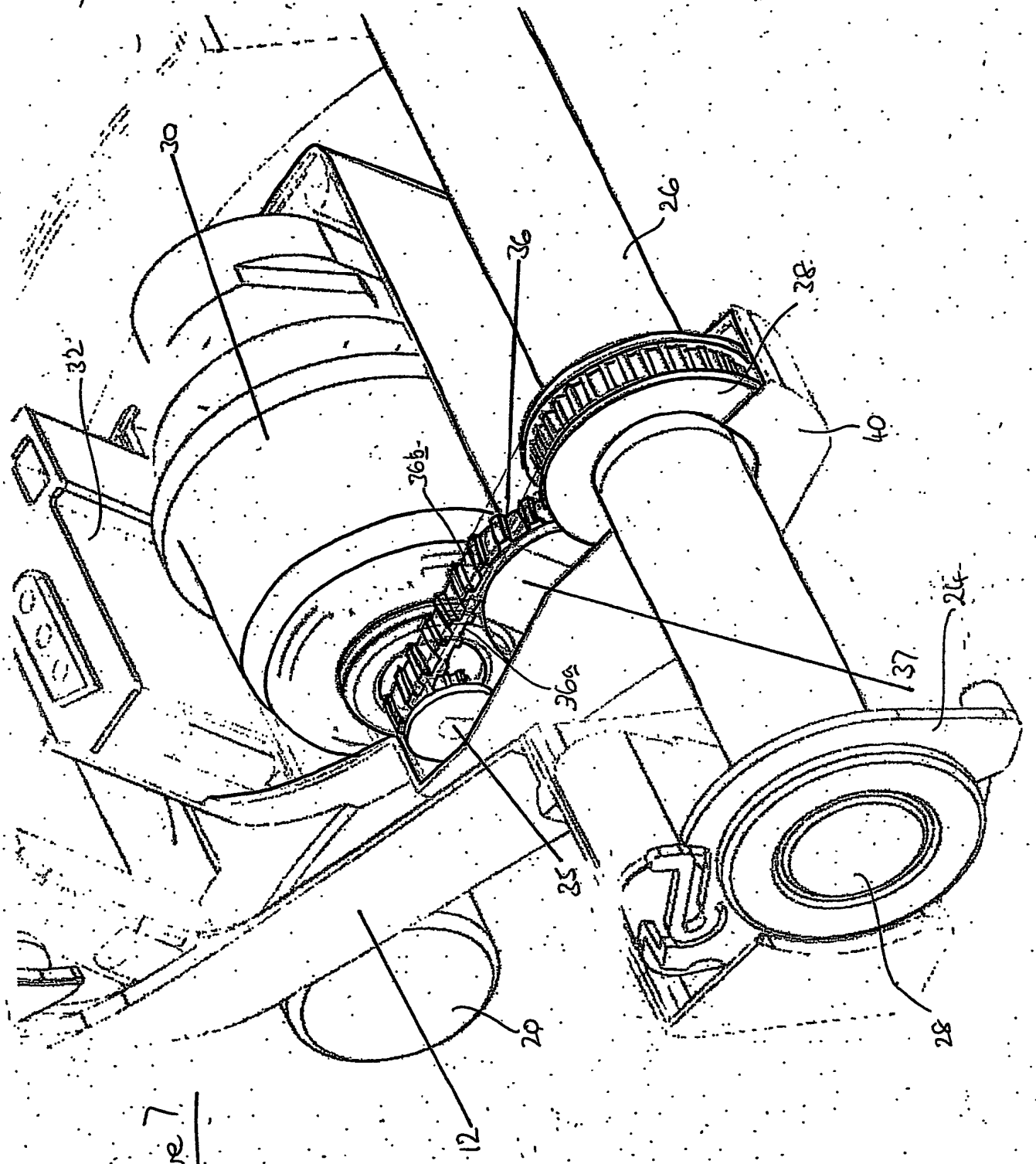

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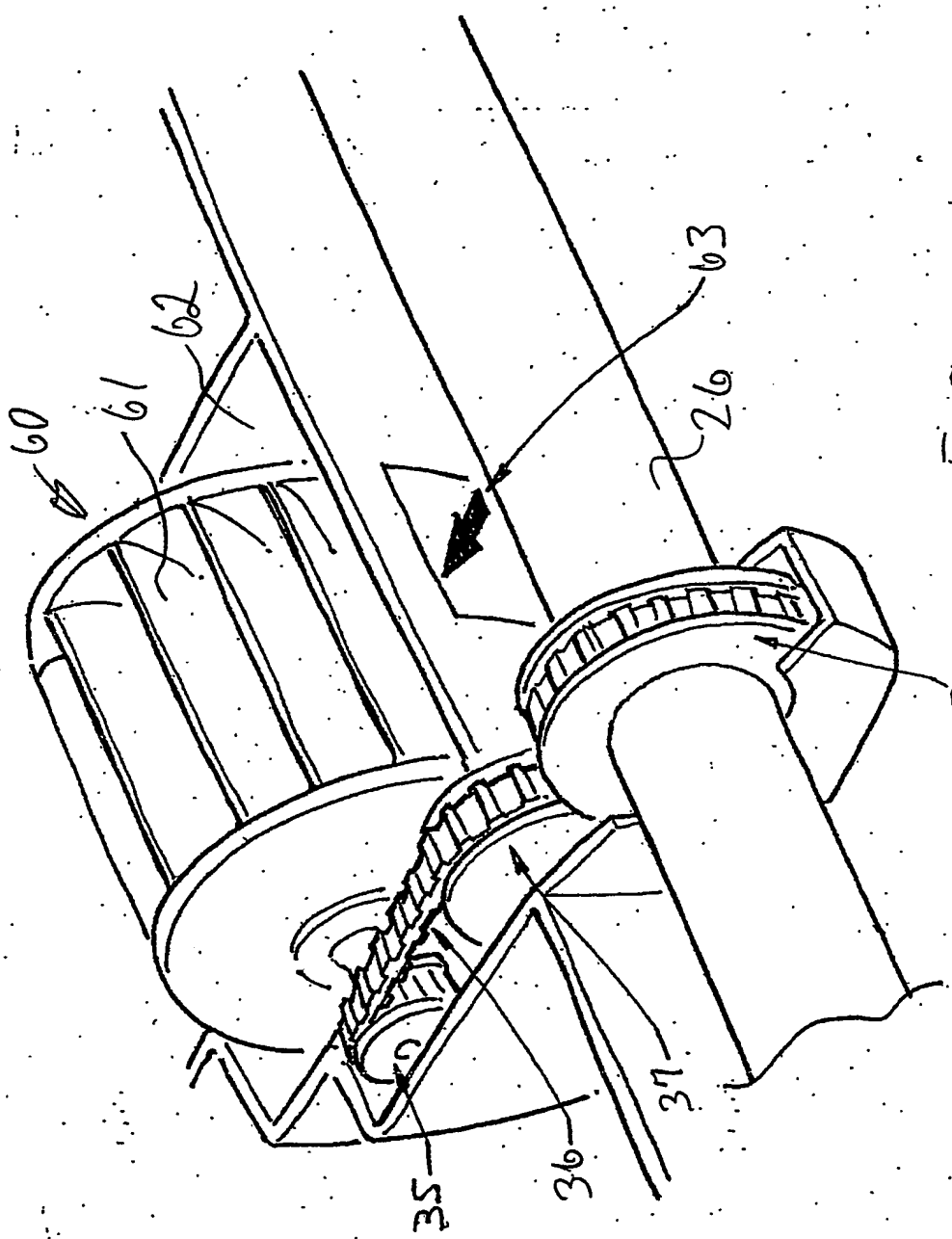

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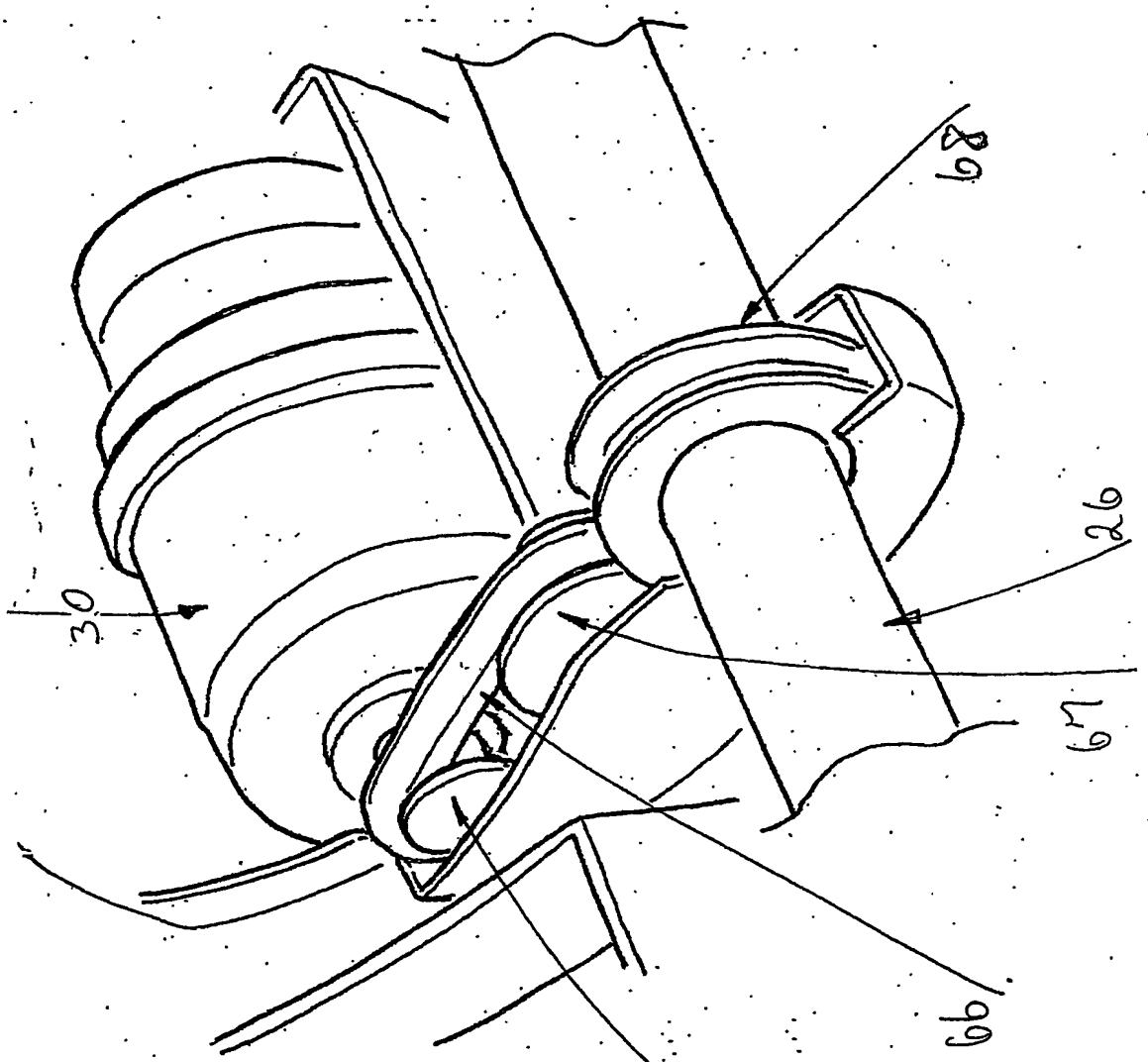


Fig 9

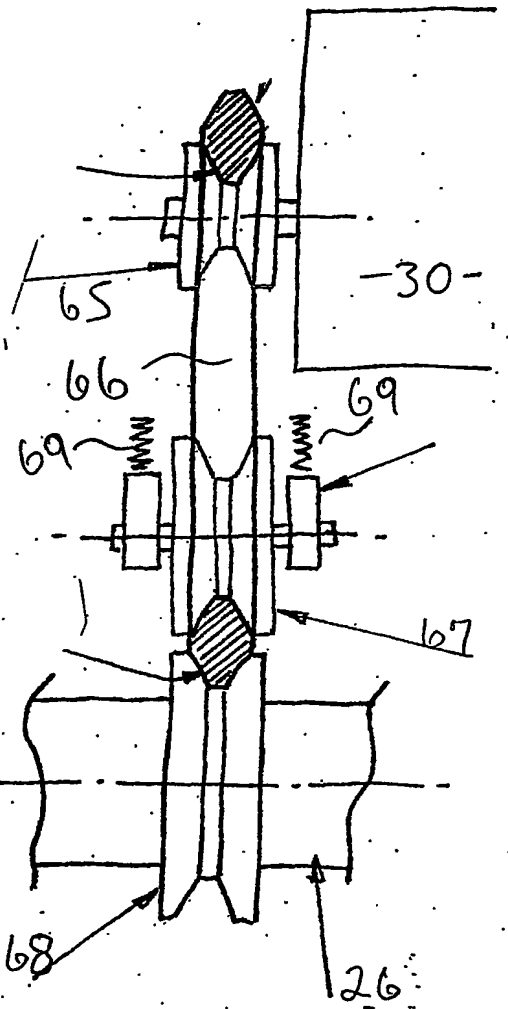


Fig.10

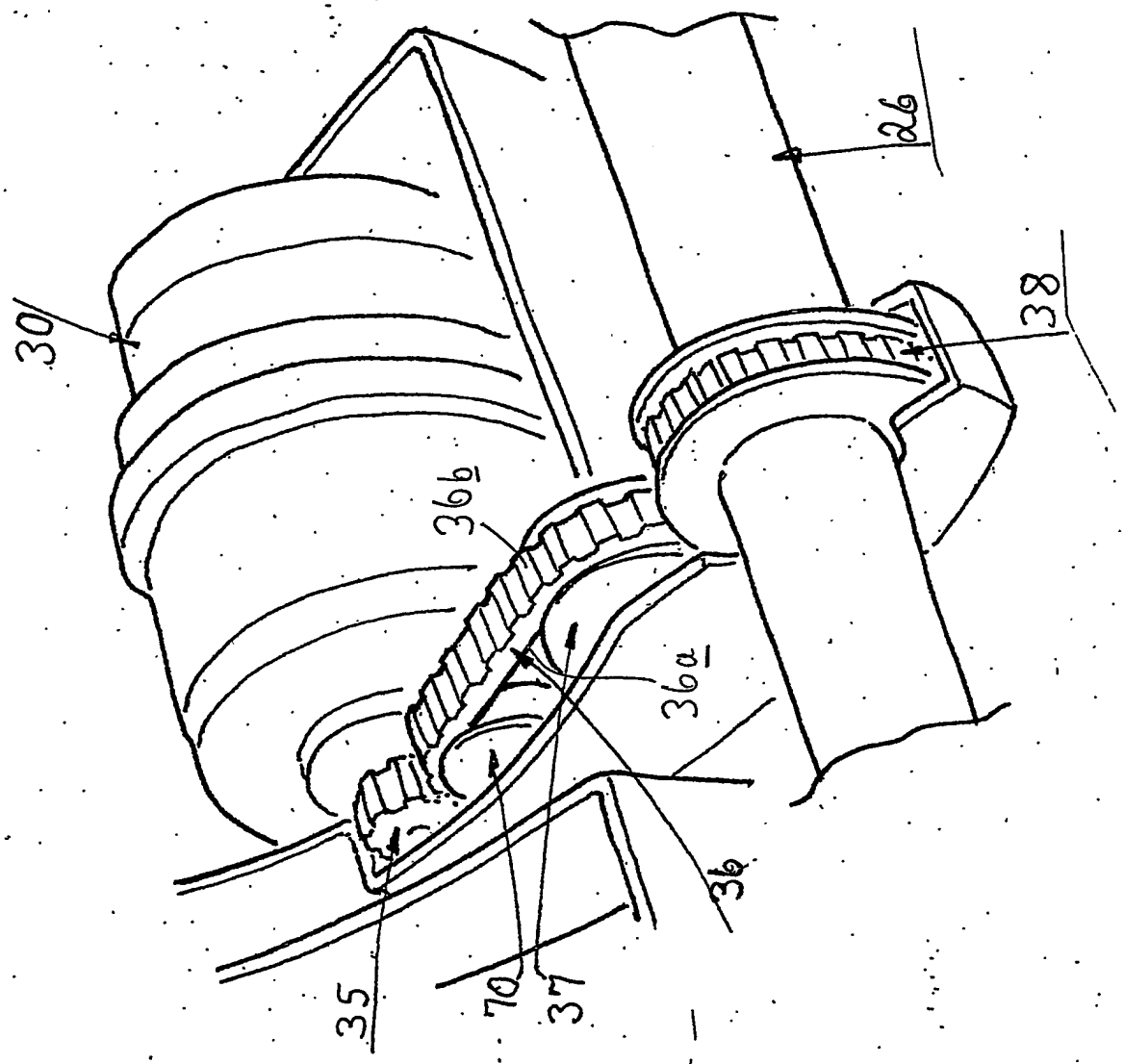
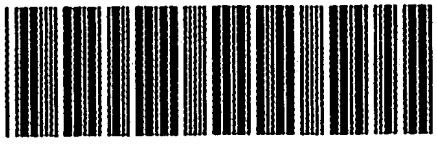


Fig 11

PCT Application

GB0305301



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